Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

"Novel nanozymes to replace natural enzyme in bioassays and beyond"

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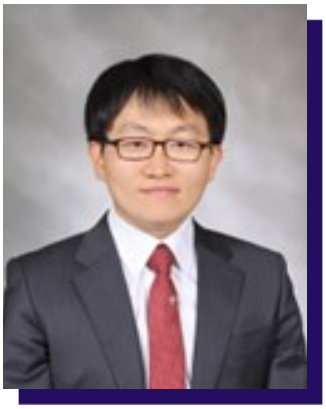

Dr. Moon Il Kim is an associate professor at the department of BioNano Technology, Gachon University, Korea. He received his Ph.D. in Chemical & Biomolecular Engineering from KAIST in 2006 and joined Gachon University in 2014. Until now, he has published about 110 international papers in the prestigious journals including ACS Nano, Advanced Functional Materials, Biosensors and Bioelectronics, Analytical Chemistry, and ACS Applied Materials & Interfaces, and holds 14 international or domestic patents. He also co-founded NIET Inc., a company developing innovative diagnostic kits using nanozyme technology, in 2020. His research interests include nano-biotechnology for biosensor and biomedical engineering, cell-based biosensor and biochip, and enzyme engineering.

ABSTRACT

Recently, nanozymes have been intensively studied due to their superior qualities such as extremely high stability with robustness even under stringent conditions, tunable catalytic activity and specificity, and ability to be synthesized on a large-scale at low costs. In this presentation, I will discuss the current progresses how to develop novel nanozymes and their representative applications in biosensing technology. First, I will describe a new and simple colorimetric strategy for the detection of nucleic acids, which relies on target DNA-induced shielding action against the peroxidase mimicking activity of magnetic nanoparticles (MNPs) or oxidase mimicking activity of cerium oxide nanoparticles (CeO2 NPs). Second, I will discuss a nanostructured multi-catalyst system consisting of MNPs and an oxidative enzyme entrapped in large pore sized mesoporous silica for convenient colorimetric detection of biologically important target molecules. The oxidative enzyme in the multi-catalyst system generates H2O2 through its catalytic action for a target molecule, which subsequently activates MNPs to convert a selected substrate into a corresponding colored product. Besides, I will also introduce highly efficient electrochemical biosensing system by employing conductive nanocomposite and ultrafast colorimetric immunoassay system by employing a nanocomposite entrapping magnetic and platinum nanoparticles. Finally, I will describe colorimetric biosensors based on new peroxidase mimetics including Fe-aminoclay, Cu-nanoflower, N & B-doped graphene, and Fe-N4-graphene. These achievements should accelerate and widen the utility of nanozymes as next-generation alternatives to natural enzymes for bioassays and beyond.

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